

PREVALENCE OF NOISE INDUCED HEARING LOSS AMONG THE WORKERS OF METALLURGICAL FACTORY; A STUDY CONDUCTED AT NISHTAR HOSPITAL MULTAN

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ABSTRACT... Objectives: To evaluate the prevalence of noise induced hearing loss in the industrial workers and its association with age, gender and duration of exposure. **Study design:** A cross sectional study. Place and duration of study: ENT department of Nishtar Hospital Multan from July 1st 2018 to June 30th 2019. **Methodology:** Age, gender, duration of exposure, overtime workers and presence of NIHL was noted for 316 workers. Three age groups were made i.e. <30 years, 30-40 years and >40 years. Duration of exposure was categorized as <5 years, 5-15 years, and >15 years. Overtime workers were classified as those who worked for >8hours daily. Workers having NIHL were compared in both genders, age groups, exposure duration groups and according to daily duration of work. Number and percentages were calculated. Results were significant if $p \leq 0.05$. **Results:** At the time of study, 67 (21%) had developed noise induced hearing loss. Considering exposure duration of workers to noise, 12% with <5years of exposure; 28.8% with 5-15years of exposure; and 28.7% with >15years of exposure developed NIHL ($p=0.001$). Frequency of NIHL was 38.4% in overtime workers as compared to 16% among regular workers ($p<0.001$). **Conclusion:** The prevalence of NIHL is very high among the workers who are constantly exposed to noise and it rises with the prolongation of total exposure time as well as daily exposure time.

Keywords: prevalence, noise induced hearing loss (NIHL), workers, industry.

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INTRODUCTION

Occupational health is one of the most important issues for the working persons. Occupational hearing loss occurs among the individuals who are exposed to noisy environment for a long period of time. This has emerged to be a global problem. A healthy and productive worker is very important for the maintaining social as well as economic development. With the advancement of industrialization, noise pollution has emerged to be a great problem and it has put the normal human habitat in danger 1. With the human development, there have been very benefits of the technology as things have become more practical and fast. But this has been achieved at the cost of quality of human life. A byproduct of industrialization is noise which has caused a significant rise in the incidence of hearing loss 2, 3. Irreversible hearing loss occurs in the work environment where the exposure to noise is very high and necessary arrangements for protection are not available 4, 5. Noisy work environment damages the auditory system

system of the workers and hearing loss ensues if the noise levels are too high 1, 3, 5. On average, a worker can tolerate up to 85dBA of noise if working time is 8 hours daily, but the propensity of developing hearing loss depends on individual anatomy. In industrial regions, the incidence of NIHL is very high. NIHL has been characterized as progressive and irreversible sensorineural type hearing loss, predominantly damaging cochlea. NIHL is usually symmetrical and bilateral, develops over 5-10 years of noise exposure, starts from higher frequencies and stabilizes in non-exposure 5-7. Noise is auditory signal which is produced by the superposition of many disconnected frequencies 3. Millions of people are exposed to noise pollution on daily basis which is damaging their mental and physical health 8. Large portion of population resides in industrial areas where they are continuously exposed to noise, even during sleep, to which they become used to with time. Many small instruments of personal use have been introduced in the modern society which have the potential to aggravate this situation 9.

Measurement of noise levels includes the analysis of amplitude, frequencies and duration which are vital for determining the damaging potential of the noise. Learning about the amount of sound energy absorbed by the common worker of an industry is vital for physical and mental health of that worker. In order to determine the incidence of NIHL, many other factors including age, work history, preexisting ear diseases, time of daily exposure to noise and duration of previous exposure to noise are also considered [6, 7, 9]. Although, NIHL has reached the endemic magnitude in the industrial areas, the studies on this issue are very few, especially in Pakistani population. There is a huge part of working population who work as workers in any sort of factory. This study is meant to evaluate the prevalence of noise induced hearing loss in the industrial workers of the region and the association of NIHL with the duration of exposure and age.

MATERIAL AND METHODOLOGY:

This cross sectional study was conducted in ENT department of Nishtar Hospital Multan after the approval of hospital review committee. The duration of study was one year i.e. from July 1st 2018 to June 30th 2019. Total 316 workers were selected by non-probability consecutive sampling. All the workers were employed in some sort of metallurgical factory where there was constant exposure to noisy environment. Sample size was calculated from reference study [10]. The workers who have any sort of underlying ear pathology, congenital hearing loss and ruptured ear drums were excluded from the study. Written consent was obtained from all the workers after explaining to them the procedure and possible benefits of the study. After physical examination, audiometric test was conducted on all the patients. This test was performed in the acoustic chambers. We used double channel audiometer with TDH 39P earphones and audiometer manufactured by Kamplex, AD229 model, adjusted according to ISO/DIS criteria. Frequencies used for testing audiometric thresholds were 1, 2, 3, 4, 6 and 8 kHz and there were used airborne. The frequencies which were most affected in the NIHL were 3, 4 and 6 kHz and the results at these frequencies were assessed. The cases suggestive of NIHL were separated from the cases non suggestive on NIHL

were separated from the cases non suggestive on NIHL by using the above mentioned three frequencies. Despite the occupational clinical history, the criteria used to characterize the audiograms into suggestive and non-suggestive or normal was as follows: (1) workers with the score equal to or below 25 dB for all the threshold were suggestive of normal audiogram; (2) workers who had indentation of their score above 25 dB at 3, 4 and 6 kHz in their audiograms, in both air as well as bone conduction, were suggestive of NIHL; (3) the workers who did not fall in any of the above category were considered as non-suggestive of NIHL. Age, gender, duration of exposure in years, overtime workers and presence of NIHL was noted for all the individuals. Participants were divided into three age groups i.e. <30 years, 30-40 years and >40 years. Duration of exposure was categorized as <5 years, 5-15 years, and >15 years. Overtime workers were classified as those who worked for more than 8 hours daily. Workers having NIHL were compared in both genders, age groups, occupational exposure duration groups and according to daily duration of work. Chi square test was applied after putting data in SPSS v.23.0. Number and percentages were calculated for all groups. Results were significant if $p \leq 0.05$.

RESULTS

Mean age of all the workers was 38.86 ± 11.89 years. Average duration of working in the noisy environment was 11.06 ± 7.54 years. Study group included 259 male workers and 57 female workers. From the whole study group, 73 (23%) workers did overtime. At the time of study, 67 (21%) had developed noise induced hearing loss. Table-I

Upon age group stratification, 21.9% of the workers below the age of 30 years developed NIHL; 27.1% of the workers of 30-40 years of age developed NIHL; and 18.2% of the workers of >40 years of age developed NIHL, with no statistically significant difference among the age groups ($p=0.358$). Considering the time of exposure to noisy environment, 12% of the workers with <5 years or exposure developed NIHL; 28.8% of the workers with 5-15 years of exposure developed NIHL; and 28.7% of the workers with >15 years of exposure developed NIHL, with statistically significant difference among the age groups ($p=0.001$). Frequency of NIHL was

22.4% among the male workers and 15.8% among the female workers ($p = 0.269$). Frequency of NIHL was 38.4% in overtime workers as compared to 16% among the workers who workers for an average of 8 hours daily ($p < 0.001$). Table-II

Table-I

DEMOGRAPHIC DATA AND FREQUENCY OF NIHL

Effect modifier		Normal, N (%)	NIHL, N (%)	p-value
Age group	>30 years	89 (78.1)	25 (21.9)	0.358
	30-40 years	43 (72.9)	16 (27.1)	
	>40 years	117 (81.8)	26 (18.2)	
Time of exposure	<5 years	125 (88)	17 (12)	0.001
	5-15 years	57 (71.2)	23 (28.8)	
	>15 years	67 (71.3)	27 (28.7)	
Gender	Male	201 (77.6)	58 (22.4)	0.269
	Female	48 (84.2)	9 (15.8)	
Overtime worker	No	204 (84)	39 (16)	<0.001
	Yes	45 (61.6)	28 (38.4)	

NIHL= noise induced hearing loss

DISCUSSION:

In our study, the prevalence of NIHL was 21% in whole study group. NIHL was 12% in those who were exposed for <5 years to noise. This percentage was much higher in those who had prolonged exposure. Prevalence was 28.8% in those who had 5-15 years of exposure and 28.7% in those who had >15 years of exposure. The frequency of NIHL was not significantly affected by gender and age. However, the prevalence of NIHL was significantly higher in those who worked overtime on daily basis and it was observed to be 38.4%. NIHL not only depends upon the overall duration of exposure but also on daily exposure to noise for more than 8 hours. In another study, prevalence of NIHL was 28.89% in the workers of a metallurgical industry 10. While other researchers observed 48% NIHL in those who worked at a marble factory with the highest proportion being at 6 kHz 11. They observed that left ear was mostly affected by noise but the evidence is not sufficient to support this theory. Another study compared the prevalence of NIHL between professionals who dealt in noisy environment (microphone operators, VT operators and sound technicians) and those of other fields; and the results were 57.3% and 15.8% in the two groups, respectively 12

Lopes et al. 13 conducted a study to observe the audio health of the workers who were exposed to occupational noise. They observed normal hearing levels in 50% participants. There was indentation in the audiograms of 31.25% participants which was suggestive of newly developing NIHL. Prevalence of NIHL was 13.5% and 6.25% has some other audiometric abnormalities. It has been observed from the history of hearing loss in the workers exposed to noisy environment that an exposure of up to 10 years to occupational noise can cause permanent loss of hearing. Although the lesions are at their early stage in these people, but the damage is not reversible and can be easily detected by the audiometric tests 14. Leme et al. 15 also observed that the audiogram results were better for the right ear than for the left ear. Thus far, no physiological explanation for this aberrant behavior has been put forward. Prevalence of NIHL was observed to be 28.3% in the workers of a textile industry 16. NIHL was influenced by the age of the workers and the duration of exposure. Most of the affected workers were of 50 years to 64 years. NIHL prevalence was 42.9% among the workers who had been exposed for more than 20 years to the occupational noise pollution. Chadambuka et al. 17 observed 37% prevalence of NIHL among the industrial workers and this proportion was mostly affected by the increasing age of the worker who was exposed to noise. In another study 18, NIHL was present in 47% of the workers; hearing was mildly impaired in 35% while 12% had poor hearing. This incidence was increased with the prolongation of the exposure time to the environmental noise. Among those miners, 71% NIHL was observed among the underground workers while 28% was observed among the open ditch miners. However, the age range most affected among these miners was 20 years to 29 years. Ogido et al. 19 observed a significant relationship of hypoacusis wit age and the duration of exposure to noise. The results observed in their study included following: 13.2% workers had vertigo, 80.8% workers had tinnitus, bilateral hearing impairment was present in 70.4% workers and 74% had developed hypoacusis.

CONCLUSION:

The prevalence of NIHL is very high among the workers who are constantly exposed to noise. Moreover, NIHL prevalence rises with the prolongation of total exposure time as well as daily exposure time.

CONFLICT OF INTEREST: NIL

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